

CLAIMS

What is claimed is:

Claim 1 - A liner for an acetabular cup of an artificial hip joint, the liner sealing a top bore formed in the acetabular cup, the liner comprising in combination:

a concave inside surface adapted to contact a head of an artificial hip joint when said liner is within the acetabular cup;

an outside surface adjacent the acetabular cup when said liner is within the acetabular cup;

a rim extending between said inside surface and said outside surface at an opening into a region surrounded by said inside surface; and

a deforming seal coupled to said outside surface and adapted to abut the acetabular cup adjacent the top bore.

Claim 2 - The liner of Claim 1 wherein the top bore of the acetabular cup is surrounded by a planar shelf, and wherein said deforming seal is adapted to abut the shelf surrounding the top bore of the acetabular cup when said liner is located adjacent the acetabular cup.

Claim 3 - The liner of Claim 2 wherein said deforming seal completely surrounds the bore.

Claim 4 - The liner of Claim 3 wherein said deforming seal is formed as a unitary mass with said liner, said deforming seal formed from a common material with said liner.

Claim 5 - The liner of Claim 3 wherein said deforming seal includes a circular edge sized to abut the shelf surrounding the bore when said liner is located adjacent the acetabular cup.

Claim 6 - The liner of Claim 5 wherein said deforming seal is conical between a neck coupled to said outside surface of said liner and said circular edge of said deforming seal.

Claim 7 - The liner of Claim 6 wherein said circular edge is adapted to flex toward said outside surface of said liner when said circular edge of said deforming seal abuts the shelf surrounding the top bore of the acetabular cup.

Claim 8 - The liner of Claim 1 wherein said deforming seal is formed as a unitary mass with said liner, said deforming seal formed from a common material with said liner.

Claim 9 - The liner of Claim 8 wherein said deforming seal includes a circular edge sized to abut the shelf surrounding the bore when said liner is located adjacent the acetabular cup.

Claim 10 - The liner of Claim 9 wherein said deforming seal is conical between a neck coupled to said outside surface of said liner and said circular edge of said deforming seal; and

wherein said circular edge is adapted to flex toward said outside surface of said liner when said circular edge of said deforming seal abuts the shelf surrounding the top bore of the acetabular cup.

Claim 11 - The liner of Claim 1 further including a means to press said liner against the acetabular cup with sufficient force to deform said deforming seal against the acetabular cup adjacent the top bore.

Claim 12 - The liner of Claim 11 wherein said means to press includes an annular groove in the acetabular cup facing inward and an annular seat adjacent said rim of said liner facing outwardly; and

an annular ring sized to fit within both the groove of the acetabular cup and said seat of said liner with the groove and said seat located so that when said annular ring is located within the groove and said seat said deforming seal abuts the acetabular cup adjacent the top bore with said deforming seal is deformed.

Claim 13 - The liner of Claim 12 wherein said annular ring includes a top side spaced from a bottom side by a ring thickness that is less than a thickness of the groove of the acetabular cup and less than a thickness of the seat of the liner;

an outer side spaced from an inner side by a ring width;

said outer side having an undeformed diameter sufficient to extend at least partially into the groove of the acetabular cup;

said inner side having an undeformed diameter sufficient to extend at least partially into the seat of the liner;

said ring width less than a difference between a diameter of the groove of the acetabular cup and a diameter of the seat of the liner; and

a break in said ring, such that enlarging said break expands said outer side diameter and said inner side diameter, and narrowing said break reduces said outer diameter and said inner diameter.

Claim 14 - The liner of Claim 13 wherein said annular ring includes a captured end adjacent said break and a free end adjacent said break; and

a slot at said captured end adapted to reside over the pin of the acetabular cup when said ring is located within the groove of the acetabular cup and the seat of the liner, such that said ring holds the liner within the acetabular cup.

Claim 15 - The liner of Claim 14 wherein the top bore of the acetabular cup is surrounded by a planar shelf, and wherein said deforming seal is adapted to abut the shelf surrounding the top bore of the acetabular cup when said liner is located adjacent the acetabular cup;

wherein said deforming seal completely surrounds the bore; and

wherein said deforming seal includes a circular edge sized to abut the shelf surrounding the bore when said liner is located adjacent the acetabular cup.

Claim 16 - The liner of Claim 15 wherein said deforming seal is conical between a neck coupled to said outside surface of said liner and said circular edge of said deforming seal; and

wherein said circular edge is adapted to flex toward said outside surface of said liner when said circular edge of said deforming seal abuts the shelf surrounding the top

bore of the acetabular cup.

Claim 17 - A liner for an acetabular cup of an artificial hip joint, the acetabular cup having a top bore formed therein near a top of a generally concave interior surface of the acetabular cup, the interior surface shaped and sized to receive said liner therein, the acetabular cup adapted to be attached to a hip bone, the liner comprising in combination:

an outside surface adapted to mate within the generally concave interior surface of the acetabular cup;

a generally concave inside surface adapted to pivotably support a head of an artificial hip joint coupled to an upper end of a femur; and

a deforming seal adapted to be interposed between said outside surface and the interior surface of the acetabular cup adjacent the top bore of the acetabular cup.

Claim 18 - The liner of Claim 17 wherein the top bore of the acetabular cup is surrounded by a planar shelf, and wherein said deforming seal is adapted to abut the shelf surrounding the top bore of the acetabular cup when said liner is located adjacent the acetabular cup.

Claim 19 - The liner of Claim 17 wherein said deforming seal is coupled to said outside surface of said liner.

Claim 20 - The liner of Claim 17 wherein said deforming seal completely surrounds said bore.

Claim 21 - The liner of Claim 17 wherein said deforming seal includes a circular edge sized to abut portions of the interior surface of the acetabular cup surrounding the top bore when said liner is located adjacent the acetabular cup.

Claim 22 - The liner of Claim 17 wherein said deforming seal is conical between a neck coupled to said outside surface of said liner and said circular edge of said deforming seal.

Claim 23 - The liner of Claim 22 wherein the top bore of the acetabular cup is surrounded by a planar shelf, and wherein said deforming seal is adapted to abut the shelf surrounding the top bore of the acetabular cup when said liner is located adjacent the acetabular cup; and

wherein said circular edge is adapted to flex toward said outside surface of said liner when said circular edge of said deforming seal abuts the shelf surrounding the top bore of the acetabular cup.

Claim 24 - The liner of Claim 23 further including a means to press said liner against the acetabular cup with sufficient force to deform said deforming seal against the acetabular cup adjacent the top bore.

Claim 25 - The liner of Claim 24 wherein said means to press includes an annular groove in the acetabular cup facing inward and an annular seat adjacent said rim of said liner facing outwardly;

an annular ring sized to fit within both the groove of the acetabular cup and said seat of said liner with the groove and said seat located so that when said annular ring is located within the groove and said seat, said deforming seal abuts the acetabular cup adjacent the top bore with said deforming seal deformed;

wherein a top side spaced from a bottom side by a ring thickness that is less than a thickness of the groove of the acetabular cup and less than a thickness of the seat of the liner;

an outer side spaced from an inner side by a ring width;

said outer side having an undeformed diameter sufficient to extend at least partially into the groove of the acetabular cup;

said inner side having an undeformed diameter sufficient to extend at least partially into the seat of the liner;

said ring width less than a difference between a diameter of the groove of the acetabular cup and a diameter of the seat of the liner; and

a break in said ring, such that enlarging said break expands said outer side diameter and said inner side diameter, and narrowing said break reduces said outer diameter and said inner diameter.

Claim 26 - A liner and acetabular cup combination for an artificial hip joint, comprising in combination:

an acetabular cup having an exterior surface adapted to abut a hip bone and adapted to be held securely to the hip bone;

said acetabular cup having a generally concave interior surface;

said acetabular cup having a top bore extending between said interior surface and said exterior surface;

a liner having an outside surface adapted to mate within said generally concave interior surface of said acetabular cup;

said liner having a generally concave inside surface adapted to pivotably support a head of an artificial hip joint coupled to an upper end of a femur; and

a deforming seal adapted to be interposed between said outside surface of said liner and said interior surface of said acetabular cup adjacent said top bore of said acetabular cup.

Claim 27 - The combination of Claim 26 wherein said deforming seal is coupled to said outside surface of said liner.

Claim 28 - The combination of Claim 27 wherein said deforming seal is formed as a unitary mass with said liner, said deforming seal formed from a common material with said liner.

Claim 29 - The combination of Claim 26 wherein said deforming seal completely surrounds said bore.

Claim 30 - The combination of Claim 26 wherein said deforming seal is conical between a neck coupled to said outside surface of said liner and said circular edge of said deforming seal.

Claim 31 - The combination of Claim 30 wherein said top bore of said acetabular cup is surrounded by a planar shelf, and wherein said deforming seal is adapted to abut said shelf surrounding said top bore of said acetabular cup when said liner is located adjacent said acetabular cup; and

wherein said circular edge is adapted to flex toward said outside surface of said liner when said circular edge of said deforming seal abuts said shelf surrounding said top bore of said acetabular cup.

Claim 32 - The combination of Claim 26 further including a means to press said liner against said acetabular cup with sufficient force to deform said deforming seal against said acetabular cup adjacent said top bore.

Claim 33 - The combination of Claim 32 wherein said means to press includes an annular groove in said acetabular cup facing inward and an annular seat in said liner facing outwardly; and

an annular ring sized to fit within both said groove of said acetabular cup and said seat of said liner with said groove and said seat located so that when said annular ring is located within said groove and said seat said deforming seal abuts said acetabular cup adjacent said top bore with said deforming seal deformed.

Claim 34 - The combination of Claim 33 wherein a top side spaced from a bottom side by a ring thickness that is less than a thickness of the groove of the acetabular cup and less than a thickness of the seat of the liner;

an outer side spaced from an inner side by a ring width;

said outer side having an undeformed diameter sufficient to extend at least partially into the groove of the acetabular cup;

said inner side having an undeformed diameter sufficient to extend at least partially into the seat of the liner;

said ring width less than a difference between a diameter of the groove of the acetabular cup and a diameter of the seat of the liner; and

a break in said ring, such that enlarging said break expands said outer side diameter and said inner side diameter, and narrowing said break reduces said outer diameter and said inner diameter.

Claim 35 - The combination of Claim 26 wherein said acetabular cup includes a groove extending annularly therein and facing an interior of said acetabular cup, a seat extending annularly into said liner and facing away from an interior of said liner, said seat and said groove positioned to be aligned together when said liner is located within said acetabular cup; and

a locking ring adapted to be removably located within said groove and said seat to hold said liner within said acetabular cup with said deforming seal deformed adjacent said top bore of said acetabular cup.

Claim 36 - A liner and acetabular cup combination for an artificial hip joint, comprising in combination:

an acetabular cup having an exterior surface adapted to abut a hip bone and adapted to be held securely to the hip bone;

said acetabular cup having a generally concave interior surface;

said acetabular cup having a top bore extending between said interior surface and said exterior surface;

a liner having an outside surface adapted to mate within said generally concave interior surface of said acetabular cup;

said liner having a generally concave inside surface adapted to pivotably support a head of an artificial hip joint coupled to an upper end of a femur; and

said liner including a means to seal said top bore when said liner is located within said acetabular cup.

Claim 37 - The combination of Claim 36 wherein said sealing means includes a deforming seal coupled to said outside surface of said liner and adapted to abut said acetabular cup adjacent said top bore of said acetabular cup.

Claim 38 - The combination of Claim 36 wherein said sealing means includes a top cone having a circular edge sized to abut a portion of said generally concave interior surface of said acetabular cup surrounding said top bore.

Claim 39 - The combination of Claim 38 wherein said deforming seal is conical between a neck coupled to said outside surface of said liner and said circular edge of said deforming seal; and

wherein said circular edge is adapted to flex toward said outside surface of said liner when said circular edge of said deforming seal abuts a portion of said generally concave interior surface of said acetabular cup surrounding said top bore of said acetabular cup.

Claim 40 - The combination of Claim 39 wherein said deforming seal is formed as a unitary mass with said liner, said deforming seal formed from a common material with said liner.